**PETROGENESIS OF MARTIAN NAKHLITE MIL 03346**

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**Introduction:** Antarctic meteorite MIL 03346 is a nakhlite composed of 79% clinopyroxene, ~1% olivine and 20% vitrophyric intercumulus material. We have performed a detailed petrologic and geochemical study of this nakhlite [1] and demonstrate a near identical petrogenetic history to previously discovered nakhlites from Mars.

**Data and Discussion:** Quantitative textural study of MIL 03346 indicates long (> 1_10[1] yr) residence times for the cumulus augite, whereas the skeletal Fe-Ti oxide, fayalite and sulfide, and vitrophyric appearance of the intercumulus matrix suggests rapid cooling, most probably as a lava flow. From the relatively high forsterite contents in olivine (up to $Fo_{43}$) and the compositions of augite cores ($Wo_{38-42}En_{35-40}Fs_{22-28}$) and their Ca-Fe-rich rims, we suggest that MIL 03346 is part of the same cumulate-rich lava flow as the other nakhlites on Mars. However, MIL 03346 has experienced less equilibration and faster cooling than the other nakhlites discovered to date.

Calculated trace element concentrations based upon modal abundances of MIL 03346 and ion microprobe analysis of its constituent minerals are identical to whole-rock trace element abundances measured by ICP-MS [1]. Parental melts for augite lie parallel with whole rock and intercumulus melt trace-element compositions using experimentally defined partition coefficients [2]. This parallelism has been considered to reflect closed system crystallization for Nakhla [3], where the only significant petrogenetic process between crystallization of the augite and the eruption and emplacement of the nakhlite flow has been fractional crystallization.

A simple model for the petrogenesis of MIL 03346 and the other nakhlites (Nakhla, Governador Valadares, Lafayette, Yamato 000593, NWA 817 and NWA 998) would include (1) partial melting and ascent of melt generated from a long-term LREE depleted source [3-5], (2) crystallization of cumulus augite (± olivine, ± magnetite, ± pyrrhotite) in a shallow-level martian magma chamber, (3) eruption of the crystal-rich nakhlite magma on to the surface of Mars, (4) cooling, crystal settling, overgrowth and partial equilibration to different extents within the flow, (5) secondary alteration of the flow through hydrothermal processes, possibly immediately succeeding or even during emplacement of the flow. Ultimately, MIL 03346 and the other nakhlites preserve a record of magmatic processes in volcanic rocks on Mars with analogous petrogenetic histories to pyroxene-rich terrestrial lava flows (e.g., [6]) and to Komatiites.

**References:** [1] Day J.M.D. *et al.* (2005) *Meteoritics and Planetary Science*, submitted. [2] McKay G. *et al.* (1994) *Lunar Planet. Sci. Conf. (Ab.)* XXV, 883-884. [3] Wadhwa M., Crozaz G. (1995) *Geochimica et Cosmochimica Acta,* **59**, 3629-3645. [4] Longhi J. (1991) *Proc. Lunar Planet. Sci. Conf.* **21st**, 695-709. [5] Shih C.-Y. *et al.* (1999) *Meteoritics and Planetary Science*, **34**, 647-655. [6] Lentz R.C.F *et al.* (1999) *Meteoritics and Planetary Science,* **34**, 919-932.